



pontocerebellar hypoplasia

Pontocerebellar hypoplasia is a group of related conditions that affect the development of the brain. The term "pontocerebellar" refers to the pons and the cerebellum, which are the brain structures that are most severely affected in many forms of this disorder. The pons is located at the base of the brain in an area called the brainstem, where it transmits signals between the cerebellum and the rest of the brain. The cerebellum, which is located at the back of the brain, normally coordinates movement. The term "hypoplasia" refers to the underdevelopment of these brain regions.

Pontocerebellar hypoplasia also causes impaired growth of other parts of the brain, leading to an unusually small head size (microcephaly). This microcephaly is usually not apparent at birth but becomes noticeable as brain growth continues to be slow in infancy and early childhood.

Researchers have described at least ten types of pontocerebellar hypoplasia. All forms of this condition are characterized by impaired brain development, delayed development overall, problems with movement, and intellectual disability. The brain abnormalities are usually present at birth, and in some cases they can be detected before birth. Many children with pontocerebellar hypoplasia live only into infancy or childhood, although some affected individuals have lived into adulthood.

The two major forms of pontocerebellar hypoplasia are designated as type 1 (PCH1) and type 2 (PCH2). In addition to the brain abnormalities described above, PCH1 causes problems with muscle movement resulting from a loss of specialized nerve cells called motor neurons in the spinal cord, similar to another genetic disorder known as spinal muscular atrophy. Individuals with PCH1 also have very weak muscle tone (hypotonia), joint deformities called contractures, vision impairment, and breathing and feeding problems that are evident from early infancy.

Common features of PCH2 include a lack of voluntary motor skills (such as grasping objects, sitting, or walking), problems with swallowing (dysphagia), and an absence of communication, including speech. Affected children typically develop temporary jitteriness (generalized clonus) in early infancy, abnormal patterns of movement described as chorea or dystonia, and stiffness (spasticity). Many also have impaired vision and seizures.

The other forms of pontocerebellar hypoplasia, designated as type 3 (PCH3) through type 10 (PCH10), appear to be rare and have each been reported in only a small number of individuals. Because the different types have overlapping features, and some are caused by mutations in the same genes, researchers have proposed that the types be considered as a spectrum instead of distinct conditions.

Frequency

The prevalence of pontocerebellar hypoplasia is unknown, although most forms of the disorder appear to be very rare.

Genetic Changes

Pontocerebellar hypoplasia can result from mutations in several genes. About half of all cases of PCH1 are caused by mutations in the *EXOSC3* gene. PCH1 can also result from mutations in several other genes, including *TSEN54*, *RARS2*, and *VRK1*. PCH2 is caused by mutations in the *TSEN54*, *TSEN2*, *TSEN34*, or *SEPSECS* gene. In addition to causing PCH1 and PCH2, mutations in the *TSEN54* gene can cause PCH4 and PCH5. Mutations in the *RARS2* gene, in addition to causing PCH1, can result in PCH6. The remaining types of pontocerebellar hypoplasia are caused by mutations in other genes. In some cases, the genetic cause of pontocerebellar hypoplasia is unknown.

The genes associated with pontocerebellar hypoplasia appear to play essential roles in the development and survival of nerve cells (neurons). Many of these genes are known or suspected to be involved in processing RNA molecules, which are chemical cousins of DNA. Fully processed, mature RNA molecules are essential for the normal functioning of all cells, including neurons. Studies suggest that abnormal RNA processing likely underlies the abnormal brain development characteristic of pontocerebellar hypoplasia, although the exact mechanism is unknown. Researchers hypothesize that developing neurons in certain areas of the brain may be particularly sensitive to problems with RNA processing.

Some of the genes associated with pontocerebellar hypoplasia have functions unrelated to RNA processing. In most cases, it is unclear how mutations in these genes impair brain development.

Inheritance Pattern

This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.

Other Names for This Condition

- congenital pontocerebellar hypoplasia
- OPCH
- PCH

Diagnosis & Management

Genetic Testing

- Genetic Testing Registry: Pontocerebellar hypoplasia type 1
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1843504/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 2
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C2932714/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 2A
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1848526/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 2B
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C2676466/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 2C
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C2676465/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 2D
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3151140/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 3
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1842687/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 4
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1856974/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 5
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1857762/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 6
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1969084/>
- Genetic Testing Registry: Pontocerebellar hypoplasia type 8
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3554209/>
- Genetic Testing Registry: Pontocerebellar hypoplasia, type 1b
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3553449/>
- Genetic Testing Registry: Pontocerebellar hypoplasia, type 1c
<https://www.ncbi.nlm.nih.gov/gtr/conditions/CN221091/>
- Genetic Testing Registry: Pontocerebellar hypoplasia, type 2e
<https://www.ncbi.nlm.nih.gov/gtr/conditions/CN188960/>
- Genetic Testing Registry: Pontocerebellar hypoplasia, type 7
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3554226/>

- Genetic Testing Registry: Pontocerebellar hypoplasia, type 10
<https://www.ncbi.nlm.nih.gov/gtr/conditions/CN188186/>
- Genetic Testing Registry: Pontoneocerebellar hypoplasia
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1261175/>

Other Diagnosis and Management Resources

- GeneReview: EXOSC3-Related Pontocerebellar Hypoplasia
<https://www.ncbi.nlm.nih.gov/books/NBK236968>
- GeneReview: TSEN54-Related Pontocerebellar Hypoplasia
<https://www.ncbi.nlm.nih.gov/books/NBK9673>
- MedlinePlus Encyclopedia: Microcephaly
<https://medlineplus.gov/ency/article/003272.htm>

General Information from MedlinePlus

- Diagnostic Tests
<https://medlineplus.gov/diagnostictests.html>
- Drug Therapy
<https://medlineplus.gov/drugtherapy.html>
- Genetic Counseling
<https://medlineplus.gov/geneticcounseling.html>
- Palliative Care
<https://medlineplus.gov/palliativecare.html>
- Surgery and Rehabilitation
<https://medlineplus.gov/surgeryandrehabilitation.html>

Additional Information & Resources

MedlinePlus

- Encyclopedia: Brain Structures
<https://medlineplus.gov/ency/imagepages/19236.htm>
- Encyclopedia: Microcephaly
<https://medlineplus.gov/ency/article/003272.htm>
- Health Topic: Brain Malformations
<https://medlineplus.gov/brainmalformations.html>
- Health Topic: Cerebellar Disorders
<https://medlineplus.gov/cerebellardisorders.html>

Genetic and Rare Diseases Information Center

- Pontocerebellar hypoplasia
<https://rarediseases.info.nih.gov/diseases/10977/pontocerebellar-hypoplasia>

Additional NIH Resources

- National Institute of Neurological Disorders and Stroke: Cerebellar Hypoplasia
<https://www.ninds.nih.gov/Disorders/All-Disorders/Cerebellar-hypoplasia-Information-Page>

Educational Resources

- Disease InfoSearch: Pontocerebellar hypoplasia type 1
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+1/5863>
- Disease InfoSearch: Pontocerebellar hypoplasia type 2
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+2/5864>
- Disease InfoSearch: Pontocerebellar hypoplasia type 2A
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+2A/9133>
- Disease InfoSearch: Pontocerebellar hypoplasia type 2B
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+2B/9134>
- Disease InfoSearch: Pontocerebellar hypoplasia type 2C
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+2C/9135>
- Disease InfoSearch: Pontocerebellar hypoplasia type 2D
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+2D/9136>
- Disease InfoSearch: Pontocerebellar hypoplasia type 3
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+3/5865>
- Disease InfoSearch: Pontocerebellar hypoplasia type 4
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+4/5866>
- Disease InfoSearch: Pontocerebellar hypoplasia type 5
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+5/5867>
- Disease InfoSearch: Pontocerebellar hypoplasia type 6
<http://www.diseaseinfosearch.org/Pontocerebellar+hypoplasia+type+6/5868>
- MalaCards: pontocerebellar hypoplasia
http://www.malacards.org/card/pontocerebellar_hypoplasia
- Neuromuscular Disease Center, Washington University, St. Louis: Pontocerebellar Hypoplasia
<http://neuromuscular.wustl.edu/ataxia/recatax.html#pch>
- Orphanet: Non-syndromic pontocerebellar hypoplasia
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=98523

- Orphanet: Pontocerebellar hypoplasia type 1
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=2254
- Orphanet: Pontocerebellar hypoplasia type 2
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=2524
- Orphanet: Pontocerebellar hypoplasia type 3
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=97249
- Orphanet: Pontocerebellar hypoplasia type 4
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=166063
- Orphanet: Pontocerebellar hypoplasia type 5
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=166068
- Orphanet: Pontocerebellar hypoplasia type 6
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=166073
- Orphanet: Pontocerebellar hypoplasia type 7
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=284339
- Orphanet: Pontocerebellar hypoplasia type 8
http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=324569

Patient Support and Advocacy Resources

- American Association on Intellectual and Developmental Disabilities
<http://aaidd.org/>
- National Organization for Rare Disorders (NORD)
<https://rarediseases.org/rare-diseases/pontocerebellar-hypoplasia/>
- Resource list from the University of Kansas Medical Center: Brain Conditions
<http://www.kumc.edu/gec/support/brain.html>
- The Arc
<http://www.thearc.org/>

GeneReviews

- EXOSC3-Related Pontocerebellar Hypoplasia
<https://www.ncbi.nlm.nih.gov/books/NBK236968>
- TSEN54-Related Pontocerebellar Hypoplasia
<https://www.ncbi.nlm.nih.gov/books/NBK9673>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28pontocerebellar+hypoplasia%5BTIAB%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

OMIM

- PONTOCEREBELLAR HYPOPLASIA, TYPE 1A
<http://omim.org/entry/607596>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 1B
<http://omim.org/entry/614678>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 2A
<http://omim.org/entry/277470>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 2B
<http://omim.org/entry/612389>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 2C
<http://omim.org/entry/612390>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 2D
<http://omim.org/entry/613811>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 2E
<http://omim.org/entry/615851>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 3
<http://omim.org/entry/608027>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 4
<http://omim.org/entry/225753>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 5
<http://omim.org/entry/610204>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 6
<http://omim.org/entry/611523>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 7
<http://omim.org/entry/614969>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 8
<http://omim.org/entry/614961>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 9
<http://omim.org/entry/615809>
- PONTOCEREBELLAR HYPOPLASIA, TYPE 10
<http://omim.org/entry/615803>

Sources for This Summary

- Barth PG, Aronica E, de Vries L, Nikkels PG, Scheper W, Hoozemans JJ, Poll-The BT, Troost D. Pontocerebellar hypoplasia type 2: a neuropathological update. *Acta Neuropathol.* 2007 Oct;114(4):373-86. Epub 2007 Jul 20.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/17641900>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2039791/>
- Cassandrini D, Biancheri R, Tessa A, Di Rocco M, Di Capua M, Bruno C, Denora PS, Sartori S, Rossi A, Nozza P, Emma F, Mezzano P, Politi MR, Laverda AM, Zara F, Pavone L, Simonati A, Leuzzi V, Santorelli FM, Bertini E. Pontocerebellar hypoplasia: clinical, pathologic, and genetic studies. *Neurology.* 2010 Oct 19;75(16):1459-64. doi: 10.1212/WNL.0b013e3181f88173.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/20956791>
- GeneReview: EXOSC3-Related Pontocerebellar Hypoplasia
<https://www.ncbi.nlm.nih.gov/books/NBK236968>
- GeneReview: TSEN54-Related Pontocerebellar Hypoplasia
<https://www.ncbi.nlm.nih.gov/books/NBK9673>
- Namavar Y, Barth PG, Kasher PR, van Ruissen F, Brockmann K, Bernert G, Witzl K, Ventura K, Cheng EY, Ferriero DM, Basel-Vanagaite L, Eggens VR, Krägeloh-Mann I, De Meirlier L, King M, Graham JM Jr, von Moers A, Knoers N, Sztriha L, Korinthenberg R; PCH Consortium, Dobyns WB, Baas F, Poll-The BT. Clinical, neuroradiological and genetic findings in pontocerebellar hypoplasia. *Brain.* 2011 Jan;134(Pt 1):143-56. doi: 10.1093/brain/awq287. Epub 2010 Oct 15.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/20952379>
- Namavar Y, Barth PG, Poll-The BT, Baas F. Classification, diagnosis and potential mechanisms in pontocerebellar hypoplasia. *Orphanet J Rare Dis.* 2011 Jul 12;6:50. doi: 10.1186/1750-1172-6-50. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/21749694>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3159098/>
- Rudnik-Schöneborn S, Barth PG, Zerres K. Pontocerebellar hypoplasia. *Am J Med Genet C Semin Med Genet.* 2014 Jun;166C(2):173-83. doi: 10.1002/ajmg.c.31403. Epub 2014 Jun 12. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24924738>
- Rudnik-Schöneborn S, Senderek J, Jen JC, Houge G, Seeman P, Puchmajerová A, Graul-Neumann L, Seidel U, Korinthenberg R, Kirschner J, Seeger J, Ryan MM, Muntoni F, Steinlin M, Sztriha L, Colomer J, Hübner C, Brockmann K, Van Maldergem L, Schiff M, Holzinger A, Barth P, Reardon W, Yourshaw M, Nelson SF, Eggermann T, Zerres K. Pontocerebellar hypoplasia type 1: clinical spectrum and relevance of EXOSC3 mutations. *Neurology.* 2013 Jan 29;80(5):438-46. doi: 10.1212/WNL.0b013e31827f0f66. Epub 2013 Jan 2.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/23284067>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3590055/>
- Sánchez-Albisua I, Frölich S, Barth PG, Steinlin M, Krägeloh-Mann I. Natural course of pontocerebellar hypoplasia type 2A. *Orphanet J Rare Dis.* 2014 May 5;9:70. doi: 10.1186/1750-1172-9-70.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24886362>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4019562/>

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